

WHAT IS CLAIMED IS:

1. A positive electrode active material containing a lithium transition metal composite oxide represented by the general formula $\text{LiCo}_x\text{A}_y\text{B}_z\text{O}_2$ where A denotes at least one selected from the group consisting of Al, Cr, V, Mn and Fe, B denotes at least one selected from the group consisting of Mg and Ca and x, y and z are such that $0.9 \leq x < 1$, $0.001 \leq y \leq 0.05$ and $0.001 \leq z \leq 0.05$.
2. A non-aqueous electrolyte secondary cell comprising a positive electrode, a negative electrode and a non-aqueous electrolyte interposed between said positive and negative electrodes, said positive electrode using a positive electrode active material containing a lithium transition metal composite oxide represented by the general formula $\text{LiCo}_x\text{A}_y\text{B}_z\text{O}_2$ where A denotes at least one selected from the group consisting of Al, Cr, V, Mn and Fe, B denotes at least one selected from the group consisting of Mg and Ca and x, y and z are such that $0.9 \leq x < 1$, $0.001 \leq y \leq 0.05$ and $0.001 \leq z \leq 0.05$.
3. A non-aqueous electrolyte secondary cell according to claim 2 wherein
said negative electrode uses an active material capable of doping/undoping lithium ions;
said active material being such an active material including a material selected from the group comprising a carbonaceous material, an alloy material and a polymer, including polyacetylene polymer.
4. A non-aqueous electrolyte secondary cell according to claim 3 wherein

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said negative electrode active material, capable of doping/undoping of lithium ion, comprises carbonaceous material which is selected from the group of a pyrocarbons, pitch coke, needle coke, petroleum coke, graphite, vitreous carbon fibers, sintered organic polymer compounds, carbon fiber and activated charcoal.

5. A non-aqueous electrolyte secondary cell according to claim 3 wherein

said negative electrode is a material that can be alloyed with lithium and includes a compound represented by a chemical formula $M_x M^y Li_z$ where M is a typical element of the group 3B or a metal other than the group 4B excluding carbon, M^y is one or more metal element other than the element Li and the element M, x is a numerical value larger than 0 and y, z are numerical values not less than 0.

6. A non-aqueous electrolyte secondary cell according to claim 2 wherein

said electrode is a band-shaped positive electrode and a band-shaped negative electrode, said positive electrode and said negative electrode being stacked and spirally wound by interposing a separator in-between.

7. A non-aqueous electrolyte secondary cell according to claim 2 wherein

said electrolyte is a solution of an electrolyte in a non-protonic non-aqueous solvent.

8. A non-aqueous electrolyte secondary cell according to claim 7 wherein

said electrolyte is a solution of a mixture of one or more selected from cyclic carbonates or chained carbonates.

9. A non-aqueous electrolyte secondary cell according to claim 7 wherein

said electrolyte comprises, as the cyclic carbonate, a solvent selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, vinylene carbonate and γ -butyrolactone, said electrolyte comprising, as the chained carbonate, a solvent selected from the group consisting of dimethyl carbonate, diethyl carbonate and dipropyl carbonate.

10. A method for the preparation of a positive electrode active material comprising the steps of:

(a) mixing a cobalt compound, a lithium compound, a compound of at least one element selected from the group consisting of aluminum, chromium, vanadium, manganese and iron and a compound of at least one element selected from the group consisting of magnesium and calcium, at a pre-set ratio; and

(b) sintering a mixture from said mixing step to produce a compound represented by the general formula $\text{LiCo}_x\text{A}_y\text{B}_z\text{O}_2$ where A denotes at least one selected from the group consisting of Al, Cr, V, Mn and Fe, B denotes at least one selected from the group consisting of Mg and Ca and x, y and z are such that $0.9 \leq x \leq 1$, $0.001 \leq y \leq 0.05$ and $0.001 \leq z \leq 0.05$;

said compound of at least one element selected from the group selected from the group consisting of magnesium and calcium, as used in said mixing step, being magnesium carbonate or calcium carbonate.

11. A method for the preparation of a non-aqueous electrolyte secondary cell comprising a positive electrode, a negative electrode and a non-aqueous electrolyte

interposed between said positive and negative electrodes, comprising, in producing said positive electrode, the steps of:

(a) mixing a cobalt compound, a lithium compound, a compound of at least one element selected from the group consisting of aluminum, chromium, vanadium, manganese and iron and a compound of at least one element selected from the group consisting of magnesium and calcium, at a pre-set ratio; and

(b) sintering a mixture from said mixing step to produce a compound represented by the general formula $\text{LiCo}_x\text{A}_y\text{B}_z\text{O}_2$ where A denotes at least one selected from the group consisting of Al, Cr, V, Mn and Fe, B denotes at least one selected from the group consisting of Mg and Ca and x, y and z are such that $0.9 \leq x < 1$, $0.001 \leq y \leq 0.05$ and $0.001 \leq z \leq 0.05$;

said compound of at least one element selected from the group consisting of magnesium and calcium, as used in said mixing step, being magnesium carbonate or calcium carbonate.

12. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 11 wherein

said negative electrode containing an active material capable of doping/undoping lithium ions;

said active material selected from the group comprising a carbonaceous material, and a polymer including polyacetylene polymer.

13. A method for the preparation of a non-aqueous electrolyte secondary cell

according to claim 12 wherein

said negative electrode, capable of lithium doping/undoping of lithium ion, comprises carbonaceous material which is selected from the group of pyrocarbon, pitch coke, needle coke, petroleum coke, graphites, vitreous carbon fibers, sintered organic high polymer compounds, carbon fiber, and activated charcoal.

14. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 12 wherein

said negative electrode is a material that can be alloyed with lithium and includes a compound represented by a chemical formula $M_x M'_y Li_z$ where M is a typical element of the group 3B or a metal other than the group 4B excluding carbon, M' is one or more metal element other than the element Li and the element M, x is a numerical value larger than 0 and y, z are numerical values not less than 0.

15. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 11 wherein

said electrode is a band-shaped positive electrode and a band-shaped negative electrode, said positive electrode and said negative electrode being stacked and wound spirally by interposing a separator in-between.

16. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 11 wherein

said electrolyte is a solution of an electrolyte in a non-protonic non-aqueous solvent.

17. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 16 wherein

said electrolyte is a solution of a mixture of one or more selected from cyclic carbonates or chained carbonates.

18. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 16 wherein

said electrolyte uses, as the cyclic carbonate, a solvent selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, vinylene carbonate and γ -butyrolactone, said electrolyte using, as the chained carbonate, a solvent selected from the group consisting of dimethyl carbonate, diethyl carbonate and dipropyl carbonate.

19. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 16 wherein

said electrolyte comprises one of the inorganic solid electrolyte and a high molecular solid electrolyte as material exhibiting lithium ion conductivity.

20. A method for the preparation of a non-aqueous electrolyte secondary cell according to claim 16 wherein

said electrolyte comprises one or more lithium salts selected from the group of: LiCl, LiBr, LiPF₆, LiClO₄, LiAsF₆, LiBF₄, LiCH₃SO₃, LiCF₃SO₃, LiN(CF₃SO₂)₂ or LiB(C₆H₅)₄.